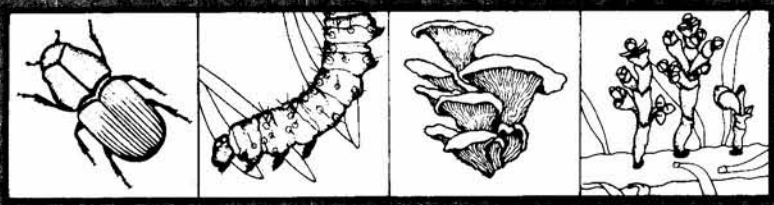
Forest Pest Management



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SPHAEROPSIS BLIGHT OF PONDEROSA PINE IN NORTHERN IDAHO

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ABSTRACT

Ponderosa pine with varying degrees of branch dieback occur in several areas of northern Idaho. Increasing levels of branch dieback have become apparent during the past few years. Isolations from symptomatic branches collected from eighteen locations during 1991 yielded cultures of *Sphaeropsis sapinea* from all but one site. The current prevalence of Sphaeropsis blight in northern Idaho may be related to a combination of weather-related factors which have favored spread and intensification of the disease.

INTRODUCTION

For several years pest specialists with the Idaho Department of Lands and USDA Forest Service have observed ponderosa pine (*Pinus ponderosa* Laws.) with varying degrees of branch dieback in northern Idaho and western Montana. Affected trees have been particularly common along the Clearwater River west of Orofino, Idaho and near Flathead Lake, Montana. Increased numbers of symptomatic trees were evident in some areas during the 1980s. More recently, similar symptoms have been observed for the first time in several other areas in northern Idaho.

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Typical symptoms include death of the tips of one or more branches scattered throughout the crown, with tan to brown needles adhering to dead branch tips (Figure 1). More severely-affected trees may have several scattered large branches and most of the top branches killed (Figure 2). Although few trees have died, the potential for damage to ponderosa pine in northern Idaho is significant, particularly if bark beetles attack trees weakened by the loss of many branches.

Several possible abiotic and biotic factors are potentially associated with branch death observed in northern Idaho. Sphaeropsis blight, a fungus disease caused by *Sphaeropsis sapinea* [Fr.] Dyko & Sutton (= *Diplodia pinea* [Desm.] Kickx.) which affects many different pine species including ponderosa, has been previously confirmed in northern Idaho (James and others 1987) and western Montana (Byler, personal communication). Ponderosa pine may also be affected by western gall rust (*Endocronartium harknessii* [Moore] Hirat.) and western dwarf mistletoe (*Arceuthobium campylopodum* Engelm.) in northern Idaho.

Figure 1.--Symptomatic ponderosa pine infected with *Sphaeropsis sapinea* with brown needles adhering to the branch.

Margarodid scale (*Matsucoccus* spp.), gouty pitch midge (*Cecidomyia piniinopsis* O. S.), black pineleaf scale (*Nuculaspis californica* Coleman), and pine needle scale (*Chionaspis pinifoliae* Fitch) have also been collected from several ponderosa pine. All these pests can cause branch dieback of ponderosa pine. Drought conditions which have prevailed in much of Idaho recently may have weakened ponderosa pine sufficiently to predispose them to damage by insects and diseases.

Because the impact on ponderosa pine could be significant if the branch dieback continues to increase, an investigation was initiated to determine if diseases and/or insects were consistently associated with the branch dieback observed in northern Idaho.

Figure 2.--Ponderosa pine severely infected with *Sphaeropsis sapinea* in Coeur d'Alene, Idaho.

METHODS

From February thru April 1991, branch collections from trees exhibiting tip dieback symptoms were made at 18 locations throughout northern Idaho (Table 1). Branches were examined for presence of any diseases or insects that could be readily identified under a dissecting microscope (10-50X). Isolations of associated fungi were attempted from bark and wood sections within the margins of dead cambial tissues. Selected tissues were surface sterilized in a 10 percent bleach solution (0.525 percent aqueous sodium hypochlorite) and placed on 2 percent water agar. Plates were incubated for 3-5 weeks in the dark at approximately 20°C. Identification of fungi originating from diseased branches was based on colony morphology and characteristics of fruiting bodies and spores.

Table 1.--Locations, collection dates and isolation results from branches displaying dieback symptoms in northern Idaho.

Location	Collection Date	*Sphaeropsis sapinea* Isolated
City Park, Coeur d'Alene	2/09/91	Yes
North State Hospital, Orofino	2/15/91	Yes
Lenora Rest Stop, Highway 12	2/15/91	Yes
Potlatch Hill, Highway 95	2/15/91	Yes
Two miles south of Plummer, Highway 95	2/15/91	Yes
Farragut State Park	3/28/91	Yes
Rathdrum	3/28/91	Yes
Post Falls High School	3/28/91	Yes
Downtown Post Falls	3/28/91	Yes
Rest Stop (I-90) near Coeur d'Alene	3/28/91	Yes
Lincoln Way, Coeur d'Alene	3/28/91	Yes
Five miles NW of St. Maries	4/05/91	Yes
Cave Lake	4/05/91	Yes
Deary Grade - Site 1	4/16/91	Yes
Deary Grade - Site 2	4/16/91	Yes
Three miles north of Clearwater River, near Kendrick	4/16/91	Yes
Bloom Hill, Bonners Ferry	4/19/91	Yes
City Park, Bonners Ferry	4/19/91	No

RESULTS AND DISCUSSION

All sampled branches with dieback symptoms were extensively colonized with *S. sapinea* except the collection from the city park in Bonners Ferry (Table 1). All cultures of *S. sapinea* grew rapidly, covering standard size petri plates (100mm x 15mm) in less than five days. Their rapid growth and abundant production of aerial mycelium in culture indicated that the isolates were probably the more virulent (Type A) strains of *S. sapinea* described by Palmer (1991) and Palmer and others (1987).

Sphaeropsis blight affects more than 20 species of pine throughout the world (Peterson 1981). The most conspicuous symptoms of this disease are tan to brown, sometimes stunted, terminal needles of branches. Infection most commonly occurs through needle stomata, but can also occur through wounds caused by hail or insects (Brookhouser and 1971; Haddow and Newman 1942; Peterson and Johnson 1986; Swart and Wingfield 1991). Prolonged moist conditions are required for spore dispersal, spore germination, and

infection (Brookhouser and Peterson 1971; Peterson 1977). After the fungus penetrates needles, it rapidly colonizes needle tissues to the branch. It then kills bark and cambial tissues. As the fungus colonizes the branch, needles die and turn tan to brown (Figure 1). Cambial tissues of infected branches are killed and turn dark brown. There is often a distinct zone where dead cambium meets living cambium, discernable by color differentiation; the fungus is most active and easily isolated from this zone. After 2-3 years of successive infection on the same tree, the top can be extensively damaged (Figure 2).

Sphaeropsis sapinea produces small, black fruiting bodies (pycnidia) on necrotic needles, fascicle sheaths, scales of second-year cones, and bark of infected branches (Figure 3). Spores produced in pycnidia from March through November are typically transparent at first, becoming dark brown as they mature. Most are single celled. Many pycnidia develop on cone scales the year after seeds are shed (Peterson 1981).

Although pine of all ages are susceptible to the disease, older trees appear more severely affected in northern Idaho. It has been suggested this pattern is related to buildup of infection on seed cones which are more common on older trees (Peterson and Johnson 1986). Pine in urban environments seem to be more severely affected in northern Idaho. This may be related to subtle stresses these trees experience such as soil compaction, which are common in urban settings. Sinclair and others (1987) believe that older twigs and branches are damaged only when trees are predisposed by drought, compacted soil, root injury, or excessive heat or shade.

Figure 3.--Pycnidia of *Sphaeropsis sapinea* on ponderosa pine branch with dieback symptoms.

Although Sphaeropsis blight kills current-year shoots, major branches, and sometimes entire trees, overall impact of the disease in northern Idaho is unknown. Little is known concerning epidemiology of the disease in native ponderosa pine stands. Because many ponderosa pine stands have uninfected trees growing next to heavily-diseased trees, it is possible that some trees are resistant to *S. sapinea*. However, resistance may or may not affect overall impact in stands. Sphaeropsis blight frequently occurs in localized areas for several successive years and may decline before extensive damage occurs (Johnson and others 1981).

Although some trees in northern Idaho are severely damaged, many may recover if further infection is limited. However, it is expected that some of the most severely infected trees will either be killed by the fungus or attacked and killed by bark beetles.

Our survey indicated that Sphaeropsis blight was most severe in and around Orofino, where thousands of ponderosa pine are affected. Western pine beetle (*Dendroctonus brevicomis* LeConte) was attacking diseased trees in this area. Damage was also apparently increasing in Coeur d'Alene and Post Falls and in natural ponderosa pine stands near these communities. However, increasing western pine beetle activity was not observed in or near these areas.

Recent increases in Sphaeropsis blight in northern Idaho may be related to stresses induced by the prolonged drought which occurred from 1985 through 1989 followed by two years of extremely moist spring weather. Pine trees stressed by drought or other agents are more susceptible to damage by the disease (Bachi and Peterson 1985; Nicholls and Ostry 1990; Peterson 1981; Peterson and Johnson 1986; Sinclair and others 1987). Epidemics are promoted by wet spring weather which is favorable for spore production, dispersal and infection (Brookhouser and Peterson 1971; Peterson 1977; Peterson 1981; Sinclair and others 1987; Swart and Wingfield 1991). Cold weather may also predispose trees to damage by Sphaeropsis blight (James and others 1979); northern Idaho experienced periods of unusually low temperatures during the winters of 1989 and 1990.

It is possible that previous Sphaeropsis blight outbreaks have occurred, but were not reported, in northern Idaho. In Montana, disease outbreaks were reported during the early 1980s and levels since then have fluctuated. This disease may have occurred in the northern Rocky Mountains for some time, although confirmation of *S. sapinea* as the cause of pine branch dieback has not been common.

Margarodid scale insects were observed on several symptomatic branches. Heavy infestations of these insects can produce typical dieback symptoms on branches of ponderosa pine (Furniss and Carolin 1977). However, several sampled branches with dieback symptoms had few, if any, scales and sometimes scale insects were found on branches without dieback symptoms. Haddow and Newman (1942) demonstrated that *S. sapinea* can enter pine branches through insect wounds. However, Palmer and others (1987) reported Type B strains of *S. sapinea* (slow-growing, appressed colonies) usually associated with insect wounds. All of our isolates were classified as the more virulent Type A strains based on descriptions of Palmer and others (1987). Although insect feeding may contribute to damage by *S. sapinea* in northern Idaho, we feel it is not the major cause of the problem nor a prerequisite for disease.

Damage from Sphaeropsis blight can be reduced with fungicide applications (Peterson 1977, 1978, 1981; Peterson and Wysong 1968; Schweitzer and Sinclair 1976; Swart and Wingfield 1991). Fungicides are usually applied in the spring just after budbreak. Bordeaux mixture (4 lbs. copper sulfate, 4 lbs. hydrated lime, mixed in 50 gals. water) (Peterson 1977, 1978) and benomyl (Schweitzer and Sinclair 1976) have proven effective in reducing damage. Unfortunately, spraying large trees several times during the spring is usually not feasible in most urban and natural pine stands. In addition, fungicides may not effecively limit infections which can occur throughout the growing season from seed cones. Fungicides are most effective on small trees or on nursery stock (James and others 1987; Palmer and Nicholls 1986).

Although pruning branches may improve appearance of lightly infected trees, it will probably not prevent further infections if conditions prevail which favor spread of the disease (Peterson and Johnson 1986).

Severity of Sphaeropsis blight in northern Idaho in the future will probably be dictated by weather conditions. If disease-favorable conditions prevail for the next several years, disease severity will be expected to increase. On the other hand, if weather conditions are not conducive to disease development, decreasing levels of damage may be expected. Disease incidence and severity will be monitored closely during the next several years.

LITERATURE CITED

Bachi, P. R. and J. L. Peterson. 1985. Enhancement of *Sphaeropsis sapinea* stem invasion of pines by water deficits. Plant Disease 69:798-799.

Brookhouser, L. W. and G. W. Peterson. 1971. Infection of Austrian, Scots, and ponderosa pines by *Diplodia pinea*. Phytopathology 61:409-414.

Furniss, R. L. and V. M. Carolin. 1977. Western forest insects. USDA Forest Service, Miscellaneous Publication No. 1339. 654p.

Haddow, W. R. and F. S. Newman. 1942. A disease of Scots pine (*Pinus sylvestris* L.) caused by the fungus *Diplodia pinea* Kickx. associated with the pine spittle-bug (*Aphrophora parallela* Say.). I. Symptoms and etiology. Royal Canadian Institute Transcripts 24:1-18.

Johnson, D. W., G. W. Peterson and W. G. Telfer. 1981. Diplodia tip blight of ponderosa pine in the Black Hills, South Dakota. USDA Forest Service, Rocky Mountain Region. Forest Pest Management. Report R2-81-1. 14p.

James, R. L., D. W. Johnson and W. G. Telfer. 1979. Diplodia tip blight of ponderosa pine in the Black Hills, South Dakota. USDA Forest Service, Rocky Mountain Region. Forest Insect and Disease Mangement. Biological Evaluation R2-79-8. 10p.

James, R. L., J. W. Schwandt and J. Y. Woo. 1987. An evaluation of fungicides to control Diplodia tip blight at the Fantasy Farms Nursery, Peck, Idaho. USDA Forest Service, Northern Region. Forest Pest Management. Report 87-10. 4p.

Nicolls, T. H. and M. E. Ostry. 1990. *Sphaeropsis sapinea* cankers on stressed red and jack pines in Minnesota and Wisconin. Plant Disease 74:54-56.

Palmer, M. A. 1991. Isolate types of *Sphaeropsis sapinea* associated with main stem cankers and top-kill of *Pinus resinosa* in Minnesota and Wisconsin. Plant Disease 75:507-510.

Palmer, M. A. and T. H. Nicholls. 1986. Fungicidal control of shoot blight caused by *Sphaeropsis sapinea* on red pine nursery seedlings. Plant Disease 70:194-196.

Palmer, M. A., E. L. Stewart and M. J. Wingfield. 1987. Variation among isolates of *Sphaeropsis sapinea* in the north central United States. Phytopathology 77:944-948.

Peterson, G. W. 1977. Infection, epidemiology, and control of diplodia blight of Austrian, ponderosa, and Scots pines. Phytopathology 67:511-514.

Peterson, G. W. 1978. Effective and economical methods for controlling diplodia tip blight. American Nurseryman 147:13, 66, 70, 72.

Peterson, G. W. 1981. Diplodia blight of pines. USDA Forest Service, Forest Insect and Disease Leaflet 161. 7p.

Peterson, G. W. and D. W. Johnson. 1986. Diplodia blight of pines. *In*: Riffle, J. W. and G. W. Peterson (tech. coords.). Diseases of Trees in the Great Plains. USDA Forest Service, Gen. Tech. Rept. RM-129. pp. 128-129.

Peterson, G. W. and D. S. Wysong. 1968. Diplodia tip blight of pines in the central Great Plains: damage and control. Plant Dis. Reptr. 52:359-360.

Schweitzer, D. J. and W. A. Sinclair. 1976. Diplodia tip blight on Austrian pine controlled by benomyl. Plant Dis. Reptr. 60:269-270.

Sinclair, W. A., H. H. Lyon and W. T. Johnson. 1987. Diseases of trees and shrubs. Cornell University Press, Ithaca, NY. 574p.

Swart, W. J. and M. J. Wingfield. 1991. Biology and control of *Sphaeropsis sapinea* on *Pinus* species in South Africa. Plant Disease 75:761-766.